Chapter 2

Current Emissions and Air Quality -- Criteria Pollutants

Introduction

This chapter provides statewide information on current emissions and air quality, relative to the State and national ambient air quality standards (see Chapter 5 for information on toxic air contaminants). This section gives a national perspective on how California's air quality compares with that in other areas of the nation. The second section of this chapter includes a summary table of the Statewide Emission Inventory. The table shows emissions data by four major source categories: stationary sources, area-wide sources, mobile sources, and natural sources. The third section provides more detailed information for the four major source categories in a table of the Statewide Emission Inventory by sub-category. The remaining sections of this Chapter provide information on emissions (including the high emitting facilities) and air quality on a statewide basis. This information is organized by pollutant, for ozone (and ozone precursor emissions), particulate matter (PM_{10} and $PM_{2.5}$), and CO.

Emissions are reported as annual averages, in tons per day. For most sources and pollutants that are not seasonal, this describes emissions very well. However, for some pollutants such as PM_{10} and $PM_{2.5}$, annual averages do not give an accurate indication of the seasonal nature of emissions. Therefore, they may appear to be artificially low. Many sources of PM_{10} and $PM_{2.5}$ are seasonal, including wildfires, agricultural processes, residential wood combustion, or dust storms in the Owens Valley and Mono Lake areas. Many sources of PM_{10} and $PM_{2.5}$ can also be very localized, and basinwide annual averages do not give any information about these sources.

State and local agencies have implemented many control measures during the last three decades to improve air quality. As a result, there has been a steady decline in both emissions and pollutant concentrations. However, three criteria pollutants, ozone, particulate matter, and carbon monoxide, still pose air quality problems. Existing control programs have substantially reduced ambient CO concentrations. During 2002, CO concentrations were below the levels of the State standards in all areas except Calexico and a localized area in the South Coast Air Basin. In contrast, it will be a significant challenge to reduce emissions sufficiently to attain the ozone and PM standards statewide.

Figure 2-1 shows the national 1-hour ozone design values for the top 15 urban areas in the nation, based on data for 2000 to 2002. The design values in all these areas exceed the national 1-hour standard of 0.12 ppm. Five of the top 15 areas are located in California, with the Los Angeles South Coast Air Basin and San Joaquin Valley areas ranking second and third. Unlike previous years, the top spot is not held by a California area. However, the ranking of areas can change, depending on the ozone statistic used. For example, based on the average estimated exceedance rate during 2000 to 2002, the San Joaquin Valley area would rank first (16.9 days) while the Houston-Galveston-Brazoria, Texas area would rank fourth (5.4 days.) Overall, as ozone concentrations in California decline, our air quality continues to improve relative to other areas of the nation.

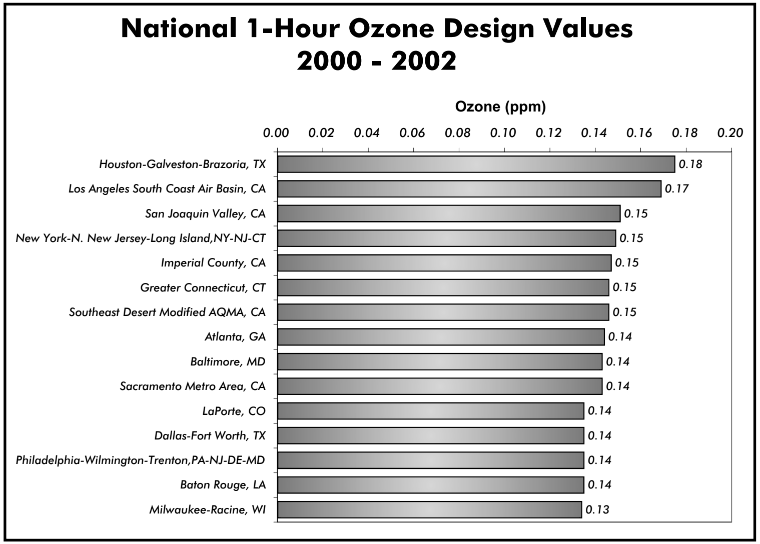

Figure 2-1

Attainment of the standards for particulate matter (PM_{10} and $PM_{2.5}$) is also a significant problem. The PM_{10} problem is most prevalent in the western United States. Eight western areas are classified as serious PM_{10} nonattainment areas. Half of these, the Coachella Valley, the Owens Valley, the San Joaquin Valley, and the South Coast Air Basin, are located in California. In contrast, the $PM_{2.5}$ problem is prevalent in both the eastern United States and in California. Because of the complex nature of the PM problem, it will be many years before the standards are attained.

Carbon monoxide poses much less of a problem. Figure 2-2 shows the five areas in the nation that averaged at least one day with CO concentrations above the level of the national standard during 2000 to 2002. The Calexico (Imperial County) and Lynwood (Los Angeles County) areas rank second and fourth, respectively. Calexico is the only area in California where the national CO standard is still violated. Los Angeles County now qualifies for attainment of the standard. The State's stringent motor vehicle emission standards and clean fuels programs continue to be effective in reducing ambient CO concentrations. Furthermore, as a result of these controls, CO concentrations in nine other California areas no longer violate the national standards, and these areas have been redesignated as attainment.

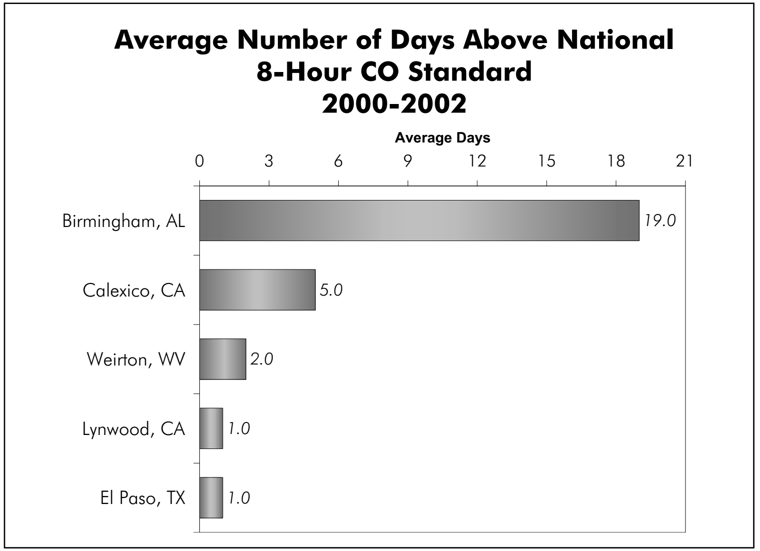

Figure 2-2

2003 Statewide Emission Inventory Summary

Division Major Category	TOG	ROG	CO	NOx	SOx	PM_{10}*	$PM_{2.5}$*
	Emissions (tons/day, annual average)						
Stationary Sources	**2455**	**511**	**386**	**512**	**134**	**128**	**83**
Fuel Combustion	194	53	323	403	40	39	34
Waste Disposal	1404	24	2	3	0	1	1
Cleaning And Surface Coatings	300	215	1	0	0	0	0
Petroleum Production And Marketing	486	159	10	11	62	3	2
Industrial Processes	71	60	50	95	31	85	46
Area-Wide Sources	**2275**	**709**	**2129**	**92**	**5**	**1833**	**585**
Solvent Evaporation	503	449	0	0	0	0	0
Miscellaneous Processes	1772	260	2129	92	5	1833	585
Mobile Sources	**1512**	**1389**	**11915**	**2705**	**116**	**125**	**102**
On-Road Motor Vehicles	956	880	8757	1674	12	49	34
Other Mobile Sources	556	509	3158	1031	104	76	68
Natural Sources**	**146**	**55**	**513**	**21**	**0**	**102**	**91**
Total Statewide - All Sources	***6387***	***2664***	***14942***	***3331***	***254***	***2188***	***860***

* Includes directly emitted particulate matter only.

** Does not include biogenic sources. These summaries do not include emissions from wind blown dust - exposed lake beds from Owens and Mono Lakes. These emissions are estimated to be about 800 tons/day.

Table 2-1

2003 Statewide Emission Inventory by Sub-Category

Division / Major Category / Sub-Category	Emissions (tons/day, annual average)						
	TOG	ROG	CO	NOx	SOx	PM_{10}*	$PM_{2.5}$*
Stationary Sources (division total)	**2455**	**511**	**386**	**512**	**134**	**128**	**83**
Fuel Combustion (major category total)	194	53	323	403	40	39	34
- Electric Utilities	26	4	51	41	3	6	6
- Cogeneration	17	9	47	31	2	4	4
- Oil And Gas Production (Combustion)	39	9	22	29	2	1	1
- Petroleum Refining (Combustion)	2	2	17	35	13	3	3
- Manufacturing And Industrial	59	9	68	132	14	7	7
- Food And Agricultural Processing	6	5	56	36	3	3	3
- Service And Commercial	40	13	42	71	3	6	5
- Other (Fuel Combustion)	5	2	20	28	1	8	4
Waste Disposal (major category total)	1404	24	2	3	0	1	1
- Sewage Treatment	1	0	0	0	0	0	0
- Landfills	1357	17	1	1	0	0	0
- Incinerators	0	0	1	2	0	0	0
- Soil Remediation	3	2	-	0	-	0	0
- Other (Waste Disposal)	42	3	0	0	-	0	0
Cleaning And Surface Coatings (major category total)	300	215	1	0	0	0	0
- Laundering	7	1	0	0	-	-	-
- Degreasing	111	45	-	-	-	-	-
- Coatings And Related Process Solvents (sub-category total)	134	126	0	0	0	0	0
- Auto Marine, & Aircraft	*23*	*22*	*0*	*0*	*0*	*0*	*0*
- Paper & Fabric	*3*	*3*	*0*	*0*	*0*	*0*	*0*
- Metal, Wood, & Plastic	*36*	*34*	*0*	*0*	*0*	*0*	*0*
- Other	*72*	*67*	*0*	*0*	*0*	*0*	*0*

* Includes directly emitted particulate matter only.

Table 2-2

2003 Statewide Emission Inventory by Sub-Category

Division Major Category Sub-Category	Emissions (tons/day, annual average) TOG	ROG	CO	NOx	SOx	PM_{10}*	$PM_{2.5}$*
Stationary Sources (division total) (continued)							
Cleaning And Surface Coatings (major category) (continued)							
- Printing	18	18	1	0	-	0	0
- Adhesives And Sealants	22	20	-	-	-	0	0
- Other (Cleaning And Surface Coatings)	8	6	-	0	-	0	0
Petroleum Production And Marketing (major category total)	486	159	10	11	62	3	2
- Oil And Gas Production	101	51	1	3	0	0	0
- Petroleum Refining	30	22	8	8	62	2	2
- Petroleum Marketing (sub-category total)	354	85	0	0	-	0	0
- Fuel Distribution Losses	*273*	*4*	*0*	*0*	*0*	*0*	*0*
- Fuel Storage Losses	*4*	*4*	*0*	*0*	*0*	*0*	*0*
- Vehicle Refueling	*52*	*52*	*0*	*0*	*0*	*0*	*0*
- Other	*26*	*26*	*0*	*0*	*0*	*0*	*0*
- Other (Petroleum Production And Marketing)	0	0	-	-	-	-	-
Industrial Processes (major category total)	71	60	50	95	31	85	46
- Chemical	25	21	1	2	4	4	3
- Food And Agriculture	22	20	3	9	1	15	7
- Mineral Processes	8	6	40	63	20	44	21
- Metal Processes	2	2	2	1	0	1	1
- Wood And Paper	4	3	1	2	0	10	6
- Glass And Related Products	1	0	0	12	5	2	2
- Electronics	1	1	0	0	-	0	0
- Other (Industrial Processes)	10	7	4	6	1	9	6

* Includes directly emitted particulate matter only.

Table 2-2 (continued)

2003 Statewide Emission Inventory by Sub-Category

Division / Major Category / Sub-Category	Emissions (tons/day, annual average) TOG	ROG	CO	NOx	SOx	PM_{10}*	$PM_{2.5}$*
Area-Wide Sources (division total)	**2275**	**709**	**2129**	**92**	**5**	**1833**	**585**
Solvent Evaporation (major category total)	503	449	0	0	0	0	0
- Consumer Products	303	253	-	-	-	-	-
- Architectural Coatings And Related Process Solvent (sub-category total)	108	105	-	-	-	-	-
- Architectural Coating	*92*	*90*	*0*	*0*	*0*	*0*	*0*
- Thinning & Cleanup Solvents	*16*	*15*	*0*	*0*	*0*	*0*	*0*
- Pesticides/Fertilizers (sub-category total)	58	58	-	-	-	-	-
- Farm Use	*56*	*56*	*0*	*0*	*0*	*0*	*0*
- Commercial Use	*2*	*2*	*0*	*0*	*0*	*0*	*0*
- Asphalt Paving / Roofing	33	33	-	-	-	0	0
Miscellaneous Processes (major category total)	1772	260	2129	92	5	1833	585
- Residential Fuel Combustion (sub-category total)	128	56	820	74	4	119	115
- Wood Combustion	*120*	*53*	*792*	*10*	*2*	*114*	*109*
- Cooking And Space Heating	*7*	*3*	*24*	*54*	*2*	*5*	*5*
- Other	*1*	*1*	*4*	*10*	*0*	*1*	*1*
- Farming Operations (sub-category total)	1495	120	-	-	-	179	43
- Tilling,Harvesting, & Growing	*0*	*0*	*0*	*0*	*0*	*146*	*32*
- Livestock	*1495*	*120*	*0*	*0*	*0*	*33*	*11*

* Includes directly emitted particulate matter only.

Table 2-2 (continued)

2003 Statewide Emission Inventory by Sub-Category

Division / Major Category / Sub-Category	Emissions (tons/day, annual average)						
	TOG	ROG	CO	NOx	SOx	PM10*	PM2.5*
Area-Wide Sources (division total) (continued)							
Miscellaneous Processes (major category) (continued)							
- Construction And Demolition (sub-category total)	-	-	-	-	-	198	41
- Building	*0*	*0*	*0*	*0*	*0*	*112*	*23*
- Road Construction Dust	*0*	*0*	*0*	*0*	*0*	*86*	*18*
- Paved Road Dust	-	-	-	-	-	400	78
- Unpaved Road Dust	-	-	-	-	-	470	103
- Fugitive Windblown Dust (sub-category total)	-	-	-	-	-	313	68
- Farm Lands	*0*	*0*	*0*	*0*	*0*	*180*	*40*
- Pasture Lands	*0*	*0*	*0*	*0*	*0*	*19*	*4*
- Unpaved Roads	*0*	*0*	*0*	*0*	*0*	*114*	*24*
- Fires	1	1	10	0	-	1	1
- Waste Burning And Disposal (sub-category total)	140	78	1298	17	1	132	122
- Agricultural Burning	*34*	*19*	*216*	*6*	*0*	*26*	*24*
- Non-Agricultural Burning	*106*	*58*	*1082*	*11*	*0*	*106*	*98*
- Other	*0*	*0*	*0*	*0*	*0*	*0*	*0*
- Cooking	8	6	-	-	-	21	13
- Other (Miscellaneous Processes)	0	0	1	0	-	1	1

* Includes directly emitted particulate matter only.

Table 2-2 (continued)

2003 Statewide Emission Inventory by Sub-Category

Division Major Category Sub-Category	Emissions (tons/day, annual average)						
	TOG	ROG	CO	NOx	SOx	PM10*	PM2.5*
Mobile Sources (division total)	**1512**	**1389**	**11915**	**2705**	**116**	**125**	**102**
On-Road Motor Vehicles (major category total)	956	880	8757	1674	12	49	34
- Light Duty Passenger (sub-category total)	449	415	3879	364	2	17	10
- Combustion and other non-evaporative	*270*	*236*	*3877*	*361*	*2*	*16*	*9*
- Evaporative	*179*	*178*	*0*	*0*	*0*	*0*	*0*
- Diesel	*1*	*1*	*2*	*3*	*0*	*0*	*0*
- Light Duty Trucks(<3750 lbs.) (sub-category total)	158	146	1624	147	1	5	3
- Combustion and other non-evaporative	*96*	*84*	*1621*	*143*	*1*	*4*	*3*
- Evaporative	*62*	*62*	*0*	*0*	*0*	*0*	*0*
- Diesel	*1*	*1*	*2*	*5*	*0*	*0*	*0*
- Light Duty Trucks (>3750 lbs) (sub-category total)	123	113	1292	167	1	6	4
- Combustion and other non-evaporative	*80*	*70*	*1291*	*164*	*1*	*6*	*4*
- Evaporative	*43*	*43*	*0*	*0*	*0*	*0*	*0*
- Diesel	*0*	*0*	*1*	*3*	*0*	*0*	*0*
- Medium Duty Trucks (sub-category total)	68	62	666	97	0	3	2
- Combustion and other non-evaporative	*46*	*41*	*665*	*94*	*0*	*3*	*2*
- Evaporative	*21*	*21*	*0*	*0*	*0*	*0*	*0*
- Diesel	*0*	*0*	*1*	*3*	*0*	*0*	*0*
- Light Heavy Duty Gas Trucks (<10000 lbs) (sub-category total)	25	23	154	17	0	0	0
- Combustion and other non-evaporative	*15*	*13*	*154*	*17*	*0*	*0*	*0*
- Evaporative	*10*	*10*	*0*	*0*	*0*	*0*	*0*
- Light Heavy Duty Gas Trucks (>10000 lbs) (sub-category total)	5	5	39	6	0	0	0
-Combustion and other non-evaporative	*3*	*3*	*39*	*6*	*0*	*0*	*0*
- Evaporative	*2*	*2*	*0*	*0*	*0*	*0*	*0*
- Medium Heavy Duty Gas Trucks (sub-category total)	31	29	236	22	0	0	0
- Combustion and other non-evaporative	*22*	*20*	*236*	*22*	*0*	*0*	*0*
- Evaporative	*10*	*10*	*0*	*0*	*0*	*0*	*0*

* Includes directly emitted particulate matter only.

Table 2-2 (continued)

2003 Statewide Emission Inventory by Sub-Category

Division Major Category Sub-Category	Emissions (tons/day, annual average)						
	TOG	ROG	CO	NOx	SOx	PM_{10}*	$PM_{2.5}$*
Mobile Sources (division total) (continued)							
On-Road Motor Vehicles (major category) (continued)							
- Heavy Heavy Duty Gas Trucks (sub-category total)	24	21	298	45	0	0	0
- Combustion and other non-evaporative	*19*	*17*	*298*	*45*	*0*	*0*	*0*
- Evaporative	*4*	*4*	*0*	*0*	*0*	*0*	*0*
- Light Heavy Duty Gas Trucks (<10000 lbs)	1	1	3	19	0	0	0
- Light Heavy Duty Gas Trucks (>10000 lbs)	1	1	3	16	0	0	0
- Medium Heavy Duty Diesel Trucks	4	4	24	144	1	4	3
- Heavy Heavy Duty Diesel Trucks	26	22	98	540	5	12	10
- Motorcycles (Mcy) (sub-category total)	22	21	163	5	-	0	0
- Combustion and other non-evaporative	*15*	*14*	*163*	*5*	*0*	*0*	*0*
- Evaporative	*7*	*7*	*0*	*0*	*0*	*0*	*0*
- Heavy Duty Diesel Urban Buses	3	2	9	47	0	1	1
- Heavy Duty Gas Urban Buses (sub-category total)	7	6	72	8	0	0	0
- Combustion and other non-evaporative	*7*	*6*	*72*	*8*	*0*	*0*	*0*
- Evaporative	*0*	*0*	*0*	*0*	*0*	*0*	*0*
- School Buses (sub-category total)	2	2	22	14	0	1	0
- Combustion and other non-evaporative	*1*	*1*	*18*	*1*	*0*	*0*	*0*
- Evaporative	*0*	*0*	*0*	*0*	*0*	*0*	*0*
- Diesel	*1*	*0*	*3*	*13*	*0*	*1*	*0*
- Motor Homes (sub-category total)	7	6	178	16	0	0	0
- Combustion and other non-evaporative	*7*	*6*	*177*	*13*	*0*	*0*	*0*
- Evaporative	*0*	*0*	*0*	*0*	*0*	*0*	*0*
- Diesel	*0*	*0*	*0*	*3*	*0*	*0*	*0*

* Includes directly emitted particulate matter only.

Table 2-2 (continued)

2003 Statewide Emission Inventory by Sub-Category

Division Major Category Sub-Category	Emissions (tons/day, annual average)						
	TOG	ROG	CO	NOx	SOx	PM_{10}*	$PM_{2.5}$*
Mobile Sources (division total) (continued)							
Other Mobile Sources (major category total)	556	509	3158	1031	104	76	68
- Aircraft	41	36	261	53	3	7	7
- Trains	10	9	32	184	16	5	5
- Ships And Commercial Boats	11	9	25	145	83	12	11
- Recreational Boats	132	123	667	28	1	8	6
- Combustion and other non-evaporative	*122*	*112*	*666*	*25*	*1*	*8*	*6*
- Evaporative	*10*	*10*	*0*	*0*	*0*	*0*	*0*
- Diesel	*1*	*1*	*1*	*3*	*0*	*0*	*0*
- Off-Road Recreational Vehicles (sub-category total)	55	50	257	4	0	0	0
- Snowmobiles	*46*	*42*	*135*	*3*	*0*	*0*	*0*
- Motorcycles	*3*	*3*	*45*	*0*	*0*	*0*	*0*
- All-Terrain Vehicles	*3*	*2*	*42*	*0*	*0*	*0*	*0*
- Four-Wheel Drive Vehicles	*3*	*3*	*35*	*1*	*0*	*0*	*0*
- Off-Road Equipment (sub-category total)	226	202	1790	485	1	34	31
- Lawn And Garden Equipment	*130*	*122*	*866*	*15*	*0*	*4*	*3*
- Combustion and other non-evaporative	*98*	*90*	*862*	*8*	*0*	*3*	*2*
- Evaporative	*32*	*32*	*0*	*0*	*0*	*0*	*0*
- Diesel	*1*	*1*	*3*	*6*	*0*	*0*	*0*
- Commercial & Industrial Equipment	*95*	*80*	*924*	*471*	*1*	*31*	*28*
- Combustion and other non-evaporative	*33*	*31*	*667*	*32*	*0*	*2*	*1*
- Evaporative	*3*	*3*	*0*	*0*	*0*	*0*	*0*
- Diesel	*51*	*45*	*175*	*408*	*0*	*28*	*26*
- Natural Gas	*8*	*1*	*82*	*31*	*0*	*0*	*0*
- Farm Equipment (sub-category total)	21	19	127	131	1	9	8
- Combustion and other non-evaporative	*3*	*3*	*68*	*2*	*0*	*0*	*0*
- Evaporative	*1*	*1*	*0*	*0*	*0*	*0*	*0*
- Diesel	*18*	*16*	*59*	*129*	*1*	*9*	*8*
- Fuel Storage and Handling	60	60	-	-	-	-	-

* Includes directly emitted particulate matter only.

Table 2-2 (continued)

2003 Statewide Emission Inventory by Sub-Category

Division Major Category Sub-Category	Emissions (tons/day, annual average)						
	TOG	ROG	CO	NOx	SOx	PM_{10}*	$PM_{2.5}$*
Natural (Non-Anthropogenic) Sources (division total)	**146**	**55**	**513**	**21**	**0**	**102**	**91**
Natural Sources** (major category total)	146	55	513	21	0	102	91
- Geogenic Sources	102	29	-	-	-	-	-
- Wildfires***	44	25	513	21	-	102	91
Total Statewide - All Sources	***6387***	***2664***	***14942***	***3331***	***254***	***2188***	***860***

* Includes directly emitted particulate matter only.
** Does not include biogenic sources. These summaries do not include emissions from wind blown dust - exposed lake beds from Owens and Mono Lakes. These emissions are estimated to be about 800 tons/day.
*** Wildfire emissions reflect 2002 data.

Table 2-2 (continued)

Ozone
2003 Statewide Emission Inventory - Ozone Precursors by Category
NO_x Sources - Statewide

NO_x is a group of gaseous compounds of nitrogen and oxygen, many of which contribute to the formation of ozone, PM_{10}, and $PM_{2.5}$. Most NO_x emissions are produced by the combustion of fuels. Industrial sources report NO_x emissions to local air districts and to the ARB. Other sources of NO_x emissions are estimated by the local air districts and the ARB. Mobile sources (including on-road and other) make up about 82 percent of the total statewide NO_x emissions. The category of other mobile sources includes emissions from aircraft, trains, ships, recreational boats, industrial and construction equipment, farm equipment, off-road recreational vehicles, and other equipment. Stationary sources of NO_x include both internal and external combustion processes in industries such as manufacturing, food processing, electric utilities, and petroleum refining. Area-wide sources, which include residential fuel combustion, waste burning, and fires, contribute only a small portion of the total NO_x emissions.

NO_X Emissions (annual average)		
Emissions Source	**tons/day**	**Percent**
Stationary Sources	512	15%
Area-Wide Sources	92	3%
On-Road Mobile	1674	51%
Gasoline Vehicles	913	28%
Diesel Vehicles	761	23%
Other Mobile	1031	31%
Total Statewide	***3309***	***100%***

Table 2-3

ROG Sources - Statewide

Reactive organic gases (ROG) are volatile organic compounds that are photochemically reactive and contribute to the formation of ozone, as well as PM_{10} and $PM_{2.5}$. These emissions result primarily from incomplete fuel combustion and the evaporation of chemical solvents and fuels. On-road mobile sources are the largest contributors to statewide ROG emissions. This category includes emissions from cars, trucks, and motorcycles powered by gasoline and diesel fuels. Stationary sources of ROG emissions include processes that use solvents (such as dry cleaning, degreasing, and coating operations) and petroleum-related processes (such as petroleum refining and marketing and oil and gas extraction). Area-wide ROG sources include consumer products, pesticides, aerosol and architectural coatings, asphalt paving and roofing, and other evaporative emissions.

ROG Emissions (annual average)		
Emissions Source	**tons/day**	**Percent**
Stationary Sources	511	20%
Area-Wide Sources	709	27%
On-Road Mobile	880	34%
Gasoline Vehicles	849	33%
Diesel Vehicles	30	1%
Other Mobile	509	20%
Total Statewide	***2609***	***100%***

Table 2-4

Largest Stationary Sources Statewide

Largest Stationary Sources of NO_x Statewide

Air Basin	Facility Name	City	Tons/Year
Mojave Desert	TXI Riverside Cement Company	Oro Grande	4496
Mojave Desert	Cemex - Black Mountain Quarry	Apple Valley	4483
San Francisco Bay Area	Mirant Delta (Electric Services)	Pittsburg	3459
Mojave Desert	California Portland Cement.	Mojave	3026
San Francisco Bay Area	Shell Martinez Refinery	Martinez	2898
San Francisco Bay Area	Tesoro Refining And Marketing	Martinez	2307
San Francisco Bay Area	Valero Refining Company	Benicia	2289
Mojave Desert	Mitsubishi Cement 2000	Lucerne Valley	2245
San Francisco Bay Area	Chevron Products Company	Richmond	2063
Mojave Desert	IMC Chemicals	Trona	1948

Facility totals are the most recent available data. Some facilities may have reduced or increased emissions since these data were collected. These changes will be reflected in subsequent almanacs.
The list of facilities does not include military bases, landfills, or airports.

Table 2-5

Largest Stationary Sources of ROG Statewide

Air Basin	Facility Name	City	Tons/Year
San Francisco Bay Area	Tesoro Refining And Marketing	Martinez	2040
San Francisco Bay Area	Chevron Products Company	Richmond	1637
San Francisco Bay Area	Shell Martinez Refinery	Martinez	1462
South Coast	Chevron USA. Inc.	El Segundo	881
San Francisco Bay Area	Conoco Phillips	Rodeo	769
San Francisco Bay Area	New United Motor Manufacturing	Fremont	581
South Coast	Mobil Oil Corp	Torrance	576
San Joaquin Valley	Crimson Resource Management (Natural Gas)	Taft	448
South Coast	West Coast Products	Carson	413
San Francisco Bay Area	Valero Refining Company	Benicia	388

Facility totals are the most recent available data. Some facilities may have reduced or increased emissions since these data were collected. These changes will be reflected in subsequent almanacs.
The list of facilities does not include military bases, landfills, or airports.

Table 2-6

Ozone - 2002 Air Quality

Air quality as it relates to ozone has improved greatly in California over the last several decades, although not uniformly throughout the State. However, despite aggressive emission controls, maximum measured ozone concentrations are still above the level of the State standard in 11 of the 15 air basins. Maximum measured values exceed the national 1-hour standard in eight air basins and exceed the national 8-hour standard in 12 air basins. California's highest ozone concentrations occur in the South Coast Air Basin, where the peak 1-hour indicator is close to two times the level of the State standard.

Ozone concentrations are generally lower near the coast than they are inland, and rural areas tend to be cleaner than urban areas. This can be explained in part by the characteristics of ozone, including pollutant reactivity, transport, and deposition. Based on current ozone concentrations, substantial additional emission control measures will be needed to attain the standards throughout the State. 2003 air quality data for California's five largest air basins can be found in Chapter 4, along with information on 8-hour ozone concentrations.

Figure 2-3

Ozone - 2002 Air Quality Tables

Maximum Peak 1-Hour Indicator and Exceedance Days by Air Basin

AIR BASIN	2002 Maximum Peak 1-Hour Indicator in parts per million	Number of Days in 2002 above State 1-Hour Standard	Number of Days in 2002 above National 1-Hour Standard
Great Basin Valleys Air Basin	0.10	8	0
Lake County Air Basin	0.08	0	0
Lake Tahoe Air Basin	0.09	1	0
Mojave Desert Air Basin	0.14	75	16
Mountain Counties Air Basin	0.14	62	8
North Central Coast Air Basin	0.10	8	0
North Coast Air Basin	0.08	0	0
Northeast Plateau Air Basin	0.09	0	0
Sacramento Valley Air Basin	0.14	47	7
Salton Sea Air Basin	0.14	68	5
San Diego Air Basin	0.12	15	0
San Francisco Bay Area Air Basin	0.13	16	2
San Joaquin Valley Air Basin	0.15	127	31
South Central Coast Air Basin	0.13	24	1
South Coast Air Basin	0.17	116	45

For statistics on the 8-Hour Ozone Standard, see Appendix B.

Table 2-7

Top Sites with Peak 1-Hour Indicator Values above the State Ozone Standard

Great Basin Valleys Air Basin
- Mammoth Lakes-Gateway HC

Mojave Desert Air Basin
- Lancaster-43301 Division Street
- Hesperia-Olive Street.
- Phelan-Beekley Rd. & Phelan Rd.
- Victorville-14306 Park Avenue
- Joshua Tree-National Monument

Mountain Counties Air Basin
- Cool-Highway 193
- Colfax-City Hall
- Placerville-Gold Nugget Way
- Grass Valley-Litton Building
- San Andreas-Gold Strike Road

North Central Coast Air Basin
- Pinnacles National Monument
- Hollister-Fairview Road

Sacramento Valley Air Basin
- Folsom-Natoma Street
- Auburn-Dewitt C Avenue
- Sloughhouse
- Rocklin-Rocklin Road
- Roseville-N Sunrise Blvd.

Salton Sea Air Basin
- Calexico-Ethel Street
- Calexico-Grant Street
- Palm Springs-Fire Station
- El Centro-9th Street
- Calexico-East

San Diego Air Basin
- Alpine-Victoria Drive
- San Diego-Overland Avenue
- Escondido-East Valley Parkway
- El Cajon-Redwood Avenue

San Francisco Bay Area Air Basin
- Livermore-793 Rincon Avenue
- San Martin-Murphy Avenue
- Gilroy-9th Street
- Fairfield-Chadbourne Road
- Concord-2975 Treat Blvd.

San Joaquin Valley Air Basin
- Parlier
- Fresno-1st Street
- Fresno-Sierra Skypark #2
- Arvin-Bear Mountain Blvd.
- Clovis-North Villa Avenue

Table 2-8

Top Sites with Peak 1-Hour Indicator Values above the State Ozone Standard

South Central Coast Air Basin

- Simi Valley-Cochran Street
- Ojai-Ojai Avenue
- Piru-3301 Pacific Avenue
- Ventura County-W Casitas Pass Rd.
- Paradise Rd.-Los Padres Nat'l Forest

South Coast Air Basin

- Crestline
- Santa Clarita
- Glendora-Laurel
- Redlands-Dearborn
- Upland

Sites with 1-hour peak indicator values above the level of the State ozone standard during 2002. The top five sites in each air basin are listed in descending order of their peak indicator value. If an air basin is not listed, the peak indicator values at sites in that air basin were not above the State ozone standard.

Table 2-8 (continued)

The Nature of Particulate Matter (PM_{10} and $PM_{2.5}$)

PM_{10} is a mixture of particles and droplets that vary in size and chemical composition, depending on each particle's origin. PM_{10} includes the subsets of "coarse" particles, those between 2.5 microns and 10 microns in diameter ($PM_{2.5-10}$), and "fine" particles, those 2.5 microns or smaller ($PM_{2.5}$). Particulate matter can be directly emitted into the air in the form of dust and soot (primary PM) or, similar to ozone, it can be formed in the atmosphere from the reaction of gaseous precursors such as NO_x, SO_x, ROG, and ammonia (secondary PM). Primary particles are mostly coarse in size, but include some fine particles, while secondary particles are mostly fine.

Sources of ambient PM include: combustion sources such as trucks and passenger cars, off-road equipment, industrial processes, residential wood burning, and forest/agricultural burning; fugitive dust from paved and unpaved roads, construction, mining, and agricultural activities; and ammonia sources such as livestock operations, fertilizer application, and motor vehicles. In general, combustion processes emit and form fine particles, whereas particles from dust sources tend to fall in the coarse range.

The levels and chemical make-up of ambient PM vary widely from one area to another. In some areas, PM levels vary strongly by season. This is due to seasonal activity increase for some emissions sources and to weather conditions that are conducive to the build-up of PM. Seasonal sources of PM include wildfires, agricultural processes, dust storms, and residential wood burning. Stagnant conditions and cool temperatures during the winter contribute to the formation of secondary ammonium nitrate and ammonium sulfate, leading to higher ambient $PM_{2.5}$ concentrations. Dry weather and windy conditions cause higher coarse PM emissions, resulting in elevated PM_{10} concentrations.

The remainder of the discussion on PM includes summary emission inventory data for directly emitted PM_{10} and $PM_{2.5}$, summary information on ambient PM_{10} and $PM_{2.5}$ concentrations, and description of the link between source emissions and ambient PM concentrations in selected regions of the State.

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Directly Emitted Particulate Matter (PM_{10})
2003 Statewide Emission Inventory - Directly Emitted PM_{10} by Category

The PM_{10} emission inventory includes only directly emitted particulate emissions. However, PM can also be formed in the atmosphere. This secondary PM_{10} is formed by reactions that are driven by emissions of ROG, NO_x, and SO_x. In urban areas (or on a seasonal basis), secondary PM may be the dominant contributor to PM_{10} levels. As a result, PM_{10} control strategies need to account for the relative contribution of both secondary and directly emitted particles.

Area-wide sources account for about 88 percent of the state-wide emissions of directly emitted PM_{10}. The major area-wide source of PM_{10} is fugitive dust, especially dust from unpaved and paved roads, agricultural operations, and construction and demolition. Fugitive dust emissions from unpaved and paved roads are related to motor vehicle population levels due to vehicular travel on both types of roads. Other sources of PM_{10} emissions include brake and tire wear, residential wood burning, and industrial sources. Exhaust emissions from mobile sources contribute a relatively small portion of directly emitted PM_{10} emissions but are a major source of the ROG and NO_x that form secondary particles. The section titled *PM_{10} and $PM_{2.5}$ - Linking Emissions Sources with Air Quality* describes how emissions from specific sources are linked to measured PM_{10} levels

Directly Emitted PM10 Emissions (annual average)		
Emissions Source	**tons/day**	**Percent**
Stationary Sources	128	6%
Area-Wide Sources	1833	88%
On-Road Mobile	49	2%
Gasoline Vehicles	31	1%
Diesel Vehicles	18	1%
Other Mobile	76	4%
Total Statewide	***2086***	***100%***

Table 2-9

Largest Stationary Sources Statewide

Largest Stationary Sources of Directly Emitted PM_{10} Statewide

Air Basin	Facility Name	City	Tons/Year
Mojave Desert	TXI Riverside Cement Company	Oro Grande	1470
Mojave Desert	Antelope Valley Aggregate	Littlerock	691
Mojave Desert	Mitsubishi Cement 2000	Lucerne Valley	600
Mountain Counties	Sierrapine - Ampine Division	Martell	518
South Coast	AES Alamitos (Electric Power)	Long Beach	405
San Francisco Bay Area	Shell Martinez Refinery	Martinez	357
Mojave Desert	Lehigh Southwest Cement.	Monolith	354
Mojave Desert	IMC Chemicals	Trona	326
Mojave Desert	Granite Construction	Littlerock	297
Mojave Desert	Cemex - Black Mountain Quarry	Apple Valley	277

Facility totals are the most recent available data. Some facilities may have reduced or increased emissions since these data were collected. These changes will be reflected in subsequent almanacs.
The list of facilities does not include military bases, landfills, or airports.

Table 2-10

Directly Emitted Particulate Matter ($PM_{2.5}$)

2003 Statewide Emission Inventory - Directly Emitted $PM_{2.5}$ by Category

The $PM_{2.5}$ emission inventory includes only directly emitted particulate emissions. However, PM can also be formed in the atmosphere. This secondary $PM_{2.5}$ is formed by reactions that are driven by emissions of ROG, NO_x, and SO_x. In urban areas (or on a seasonal basis), secondary PM may be the dominant contributor to $PM_{2.5}$ levels. As a result, $PM_{2.5}$ control strategies need to account for the relative contribution of both secondary and directly emitted particles.

Area-wide sources account for about 76 percent of the statewide emissions of directly emitted $PM_{2.5}$. The major area-wide source of $PM_{2.5}$ is fugitive dust, especially dust from unpaved and paved roads, agricultural operations, and construction and demolition. Fugitive dust emissions from unpaved and paved roads are related to motor vehicle population levels due to vehicular travel on both types of roads. Other sources of $PM_{2.5}$ emissions include brake and tire wear, residential wood burning, and industrial sources. Exhaust emissions from mobile sources contribute only a very small portion of directly emitted $PM_{2.5}$ emissions, but are a major source of the ROG and NO_x that form secondary particles. The section titled *PM_{10} and $PM_{2.5}$ - Linking Emissions Sources with Air Quality* describes how emissions from specific sources are linked to measured $PM_{2.5}$ levels

Directly Emittied $PM_{2.5}$ Emissions (annual average)		
Emissions Source	**tons/day**	**Percent**
Stationary Sources	83	11%
Area-wide Sources	585	76%
On-Road Mobile	34	4%
Gasoline Vehicles	18	2%
Diesel Vehicles	16	2%
Other Mobile	68	9%
Total Statewide	***770***	***100%***

Table 2-11

Largest Stationary Sources Statewide

Largest Stationary Sources of Directly Emitted $PM_{2.5}$ Statewide

Air Basin	Facility Name	City	Tons/Year
Mountain Counties	Sierrapine - Ampine Division	Martell	414
South Coast	AES Alamitos (Electric Power)	Long Beach	405
San Francisco Bay Area	Shell Martinez Refinery	Martinez	346
Mojave Desert	TXI Riverside Cement Company	Oro Grande	316
Mojave Desert	Mitsubishi Cement 2000	Lucerne Valley	277
Mojave Desert	Antelope Valley Aggregate Inc	Littlerock	257
South Coast	West Coast Products	Carson	246
South Coast	Chevron USA	El Segundo	239
Mojave Desert	IMC Chemicals	Trona	226
Sacramento Valley	Johns-Manville	Willows	220

Facility totals are the most recent available data. Some facilities may have reduced or increased emissions since these data were collected. These changes will be reflected in subsequent almanacs.
The list of facilities does not include military bases, landfills, or airports.

Table 2-12

PM_{10} - 2002 Air Quality

Most areas of California have either 24-hour or annual PM_{10} concentrations that exceed the State standards. Some areas exceed both State standards. Several areas, both urban and rural, also exceed the national standards. The highest annual average values during 2002 occurred in the Salton Sea, Great Basin Valleys, South Coast, San Joaquin Valley, and San Diego Air Basins. The highest 24-hour concentrations generally occurred in the desert areas where wind-blown dust contributes to local PM_{10} problems.

Particles resulting from combustion contribute to high PM_{10} in a number of urban areas. While many of the control programs implemented for ozone will also reduce PM_{10}, more controls specifically for PM_{10} will be needed to reach attainment.

PM_{10} - 2002 Air Quality Tables

Maximum 24-Hour and Annual PM_{10} Concentrations by Air Basin

AIR BASIN	2002 Maximum 24-Hour Concentration in micrograms/cubic meter		2002 Maximum Annual Average of Quarters in micrograms/cubic meter	
	State	National	State	National
Great Basin Valleys Air Basin	7401	3089	159.3	114.5
Lake County Air Basin	85		13.1	
Lake Tahoe Air Basin	46	51	17.1	19.9
Mojave Desert Air Basin	194	208	24.2	34.6
Mountain Counties Air Basin	72	76	25.9	28.5
North Central Coast Air Basin	81	77	28.9	27.9
North Coast Air Basin	72	74	22.9	22.7
Northeast Plateau Air Basin	73	86	17.5	20.3
Sacramento Valley Air Basin	96	92	31.8	30.9
Salton Sea Air Basin	361	373	82.5	81.3
San Diego Air Basin	131	130	52.4	54.9
San Francisco Bay Area Air Basin	84	80		30.6
San Joaquin Valley Air Basin	194	189	59.9	59.7
South Central Coast Air Basin	100	178	28.6	43.2
South Coast Air Basin	130	130	58.4	60.2

24-hour data - The table may include data from extreme, exceptional, or unusual concentration events: however, there is a mechanism in place to review for these types of events during the area designation process.
Annual average data - Extreme, exceptional, or unusual concentration events do not generally significantly influence the annual average. However, their exclusion can be considered on a case-by-case basis.
For additional discussion regarding differences between State and national annual averages please see the discussion in Chapter 1 - Interpreting the Emission and Air Quality Statistics.

Table 2-13

Top Sites with 24-Hour Concentrations above the State PM_{10} Standard

Great Basin Valleys Air Basin
- Dirty Sox
- Shell Cut-Highway 190
- Mono Lake Shore
- Flat Rock-Highway 190
- Lone Pine-East Locust Street

Lake County Air Basin
- Lakeport-Lakeport Blvd.

Mojave Desert Air Basin
- Mojave-923 Poole Street
- Ridgecrest-100 W. California Ave.
- China Lake-Powerline Road

Mountain Counties Air Basin
- Yosemite Village-Visitor Center

North Central Coast Air Basin
- Davenport
- Moss Landing-Sandholt Road
- Hollister-Fairview Road

North Coast Air Basin
- Willits-Firehouse
- Ukiah-County Library
- Fort Bragg-North Franklin Street
- Weaverville-Courthouse

Northeast Plateau Air Basin
- Lava Beds National Monument
- Yreka-Foothill Drive

Sacramento Valley Air Basin
- Chico-Manzanita Avenue
- Sacramento-Del Paso Manor
- Sacto.-Health Dept. Stockton Blvd.
- West Sacramento-15th Street
- Woodland-Gibson Road

Salton Sea Air Basin
- Calexico-Ethel Street
- Westmorland-West 1st Street
- Indio-Jackson Street
- El Centro-9th Street
- Brawley-Main Street

San Diego Air Basin
- Otay Mesa-Paseo International
- San Diego-12th Avenue
- El Cajon-Redwood Avenue
- Chula Vista

San Francisco Bay Area Air Basin
- Vallejo-304 Tuolumne Street
- San Francisco-Arkansas Street
- Pittsburg-10th Street
- San Jose-Jackson Street
- San Jose-Tully Street

Table 2-14

Top Sites with 24-Hour Concentrations above the State PM_{10} Standard

San Joaquin Valley Air Basin

- Bakersfield-Golden State Highway
- Corcoran-Patterson Avenue
- Hanford-South Irwin Street
- Bakersfield-5558 California Avenue
- Fresno-Drummond Street
- Visalia-North Church Street

South Central Coast Air Basin

- El Rio-Rio Mesa School #2
- Simi Valley-Cochran Street

South Coast Air Basin

- Riverside-Rubidoux
- Hawthorne
- Fontana-Arrow Highway
- Perris
- San Bernardino-4th Street

Sites with 24-hour PM_{10} concentrations above the level of the State PM_{10} standard during 2002. The top five sites in each air basin are listed in descending order of their maximum 24-hour concentration. If an air basin is not listed, the 24-hour PM_{10} concentrations at sites in that air basin were not above the State 24-hour PM_{10} standard. If more than 5 sites are listed, there were multiple sites with the same maximum concentration.

Table 2-14 (continued)

$PM_{2.5}$ Air Quality

As explained in the Introduction section of Chapter 1, the U.S. EPA promulgated new national standards (24-hour and annual average) for $PM_{2.5}$ in July 1997. In June 2002, the ARB established a new, more health-protective State annual average $PM_{2.5}$ standard. The installation of federally approved $PM_{2.5}$ mass monitors throughout California began in 1998 and is now complete, with monitors at 81 sites. Detailed information on California's $PM_{2.5}$ network can be found on the ARB website at *www.arb.ca.gov/aqd/pm25/pmfnet02.htm*.

The majority of sites in California's $PM_{2.5}$ network began sampling in early 1999. The 1999, 2000, 2001, and 2002 data are summarized in Table 2-16. For each air basin and each year, Table 2-16 lists the highest 24-hour average $PM_{2.5}$ mass concentration for State and national, the maximum 98th percentile 24-hour concentration, and the maximum annual average of quarters (annual average) for State and national. Sites in the South Coast and San Joaquin Valley Air Basins recorded the highest 24-hour concentrations, valid 98th percentile 24-hour concentrations, and valid annual average concentrations in the State. The annual averages for these areas were about twice the level of the State annual $PM_{2.5}$ standard.

Three years of complete data are required to make comparisons to the national $PM_{2.5}$ standards. However, many areas do not yet have sufficient data to make these comparisons. Although three years of complete data are also required to determine if an area attains the new State $PM_{2.5}$ standard, data showing exceedances of the standard are sufficient to determine that an area does not attain the standard.

$PM_{2.5}$ Air Quality Data

Air Basin*	Year	Maximum 24-Hour Concentration (µg/m³)		98th Percentile 24-Hour Concentration (µg/m³)**	Average of Quarterly Means (µg/m3)**	
		State	National		State	National
Great Basin Valleys	1999	40.7	40.7		6.4	
	2000	68.0	68.0	67.0	7.7	
	2001	76.0	76.0	23.0	5.6	5.5
	2002	68.0	68.0	64.0	8.7	8.4
Lake County	1999	14.5	14.5			
	2000	9.4	9.4			
	2001	15.1	15.1	11.3	4.1	4.2
	2002	74.7	74.7	46.3	6.3	6.3
Lake Tahoe	1999	21.0	21.0	21.0	8.3	8.3
	2000	23.0	23.0	22.0	7.8	7.8
	2001	31.0	31.0	26.0	8.2	8.2
	2002	27.0	27.0		6.4	
Mojave Desert	1999	47.6	47.6	23.5	11.2	11.9
	2000	38.6	38.6	23.0	13.1	12.0
	2001	35.0	35.0	21.0	12.0	11.5
	2002	38.0	38.0	34.0	13.9	13.9
Mountain Counties	1999	92.0	92.0	84.0	11.1	11.1
	2000	48.0	48.0	30.0	9.0	9.0
	2001	120.0	120.0	43.0	8.1	15.6
	2002	41.0	41.0	30.0	10.0	9.9

* The table lists the highest value for each statistic. Within an air basin, the highest value for each statistic may reflect a different site.
** These statistics and determination of their validity are calculated according to the methods specified in 40 CFR Part 50, Appendix N. Validity is based on the number of measurements available per quarter and therefore, depends on data completeness. Both the 98th percentile concentration and the average of quarters concentration relate to the national $PM_{2.5}$ standards, while only the average of quarters concentration relates to the State $PM_{2.5}$ standard.

Table 2-15

$PM_{2.5}$ Air Quality Data

Air Basin*	Year	Maximum 24-Hour Concentration (µg/m^3)		98th Percentile 24-Hour Concentration (µg/m^3)**	Average of Quarterly Means (µg/m3)**	
		State	National		State	National
North Central Coast	1999	31.3	31.4	25.0		
	2000	26.4	26.4	21.5	7.9	
	2001	25.6	25.6	23.1	9.1	
	2002	23.5	23.5	22.8	9.1	
North Coast	1999	36.9	36.9	27.7	9.1	9.1
	2000	24.0	24.0	21.5		9.1
	2001	38.3	38.3	29.0	9.4	9.4
	2002	59.7	23.7	22.6	11.4	7.9
Northeast Plateau	1999	40.0	40.0	27.0		7.9
	2000	38.0	38.0	37.0	8.5	8.5
	2001	35.0	35.0			
	2002	5.0	5.0			
Sacramento Valley	1999	108.0	108.0	84.0	17.5	17.5
	2000	98.0	98.0	81.0	15.8	15.8
	2001	78.0	72.0	78.0	21.1	13.0
	2002	96.1	91.0	77.0	19.9	15.1
Salton Sea	1999	52.5	52.5	39.5		15.2
	2000	84.2	84.2	56.0	11.2	16.9
	2001	60.2	60.2	33.0		12.2
	2002	142.7	46.5	44.1	19.6	15.1

* The table lists the highest value for each statistic. Within an air basin, the highest value for each statistic may reflect a different site.
** These statistics and determination of their validity are calculated according to the methods specified in 40 CFR Part 50, Appendix N. Validity is based on the number of measurements available per quarter and therefore, depends on data completeness. Both the 98th percentile concentration and the average of quarters concentration relate to the national $PM_{2.5}$ standards, while only the average of quarters concentration relates to the State $PM_{2.5}$ standard.

Table 2-15 (continued)

$PM_{2.5}$ Air Quality Data

Air Basin*	Year	Maximum 24-Hour Concentration (µg/m³)		98th Percentile 24-Hour Concentration (µg/m³)**	Average of Quarterly Means (µg/m3)**	
		State	National		State	National
San Diego	1999	64.3	64.3	35.7		18.0
	2000	66.3	66.3	32.5		15.8
	2001	60.0	60.0	40.8		17.7
	2002	53.6	53.6	36.0	15.5	16.0
San Francisco Bay Area	1999	90.5	90.5			
	2000	67.2	67.2	55.3	11.6	13.6
	2001	107.5	107.5	56.0	12.5	12.5
	2002	84.5	76.7	57.5	13.8	13.8
San Joaquin Valley	1999	136.0	136.0	120.0	31.2	27.7
	2000	160.0	160.0	108.0	25.5	23.9
	2001	154.7	154.7	96.0	37.9	22.5
	2002	104.3	90.8	80.4	30.5	24.1
South Central Coast	1999	64.6	64.6	35.4	13.8	13.8
	2000	55.3	55.3	41.0	12.9	10.3
	2001	57.7	57.6	50.7	14.9	14.9
	2002	46.4	46.4	35.2	15.2	14.6
South Coast	1999	121.4	121.4	111.2	22.0	31.0
	2000	119.6	119.6	83.0	24.0	28.3
	2001	98.0	98.0	74.3	46.3	31.0
	2002	82.1	82.1	66.3	31.0	27.4

* The table lists the highest value for each statistic. Within an air basin, the highest value for each statistic may reflect a different site.
** These statistics and determination of their validity are calculated according to the methods specified in 40 CFR Part 50, Appendix N. Validity is based on the number of measurements available per quarter and therefore, depends on data completeness. Both the 98th percentile concentration and the average of quarters concentration relate to the national $PM_{2.5}$ standards, while only the average of quarters concentration relates to the State $PM_{2.5}$ standard.

Table 2-15 (continued)

PM_{10} and $PM_{2.5}$ - Linking Emissions Sources with Air Quality

The size, concentration, and chemical composition of PM vary by region and by season. A number of areas exhibit strong seasonal patterns. Other areas have a much more uniform distribution with PM concentrations remaining high throughout the year. In yet other areas, isolated PM exceedances can occur at any time of the year.

In the San Joaquin Valley, the San Francisco Bay Area, and the Sacramento region, there is a strong seasonal variation in PM, with higher PM_{10} and $PM_{2.5}$ concentrations in the fall and winter months (refer to Figure 2-4). In the winter, PM_{10} and $PM_{2.5}$ concentrations remain elevated for extended periods. These higher concentrations are caused by increased activity for some emission sources and meteorological conditions that are conducive to the build-up of PM. During the winter, the $PM_{2.5}$ size fraction drives the PM concentrations, and the major contributor to high levels of ambient $PM_{2.5}$ is the secondary formation of PM caused by the reaction of NO_x and ammonium to form ammonium nitrate. The San Joaquin Valley also records high PM_{10} levels during the fall. During this season, the coarse fraction ($PM_{2.5\text{-}10}$) drives the PM concentrations.

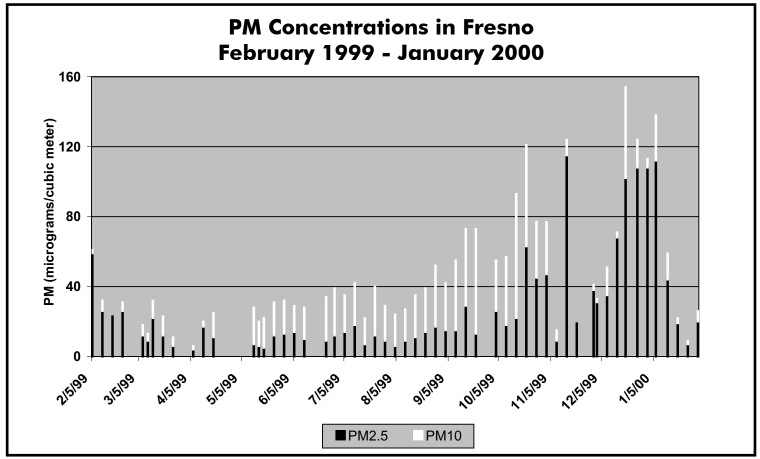

Figure 2-4

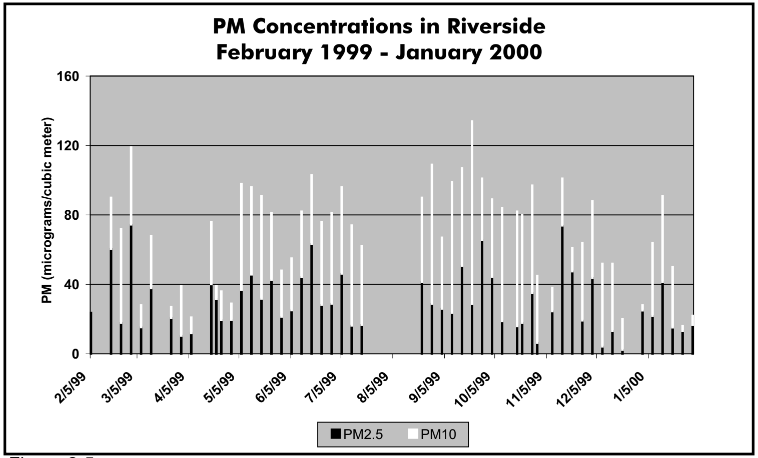

Figure 2-5

In the South Coast region, PM_{10} concentrations remain high throughout the year (refer to Figure 2-5). $PM_{2.5}$ concentrations can reach high levels in the spring, fall, and winter. The more uniform activity patterns of emission sources, as well as less variable weather patterns, leads to this more uniform concentration pattern. In other areas, high PM can be more episodic than seasonal. For example, in the Owens Lake area of the Great Basin Valleys Air Basin, episodic fugitive dust events lead to very high PM_{10} levels, with soil dust as the major contributor to ambient PM_{10}.

Analysis of PM chemical composition data collected from a variety of routine and special monitoring programs provides insight into the fraction of $PM_{2.5}$ that is secondary. Data were obtained from the California $PM_{2.5}$ and PM_{10} monitoring networks, California Regional PM_{10}/$PM_{2.5}$ Air Quality Study, Children's Health Study, Integrated Monitoring and Protected Visual Environments Program, and South Coast Air Quality Management District's PM Technical Enhancement Programs of 1995 and 1998-1999. Secondary $PM_{2.5}$ estimates include ammonium nitrate and ammonium sulfate components, which form through reactions in the atmosphere of nitrogen oxides and sulfur oxides emitted by motor vehicles and other combustion processes. $PM_{2.5}$ also includes secondary organic aerosols (SOA) resulting from atmospheric reactions of organic compounds emitted from combustion sources and biogenic processes. Since only limited information is available on how much of the measured $PM_{2.5}$ organic carbon component is secondary, SOA are not included in the secondary $PM_{2.5}$ estimates. However, available studies suggest that in the South Coast, on an annual average basis, SOA may constitute 6 to 16 percent of $PM_{2.5}$ (Schauer et. al. 1996) and in urban areas of the San Joaquin Valley, during the winter, SOA may contribute up to an average of 8 percent of $PM_{2.5}$ (Schauer and Cass, 1998).

Estimated Secondary Portion of $PM_{2.5}$ (annual average)	
Air Basin	Secondary $PM_{2.5}$ (%)
Great Basin Valleys	30
Lake County	30
Lake Tahoe	40
Mojave Desert	40
Mountain Counties	30
North Central Coast	40
North Coast	30
Northeast Plateau	30
Sacramento Valley	30
Salton Sea	40
San Diego	50
San Francisco Bay Area	40
San Joaquin Valley	40
South Central Coast	50
South Coast	60

Table 2-16

Chemical Mass Balance (CMB) models are used to establish which sources and how much of their emissions contribute to ambient PM concentrations. CMB models use chemical composition data from ambient PM samples and from emission sources. These data are often collected during special source attribution studies. The source attribution data presented in this section were derived from a variety of studies with differing degrees of chemical speciation. In general, however, the source categories can be interpreted in the following manner. The road and other dust, wood smoke, cooking, vehicle exhaust, and construction categories represent sources which directly emit particles. Road and other dust represents the combination of mechanically disturbed soil (paved and unpaved roads, agricultural activities) and wind-blown dust. Wood smoke generally represents residential wood combustion, but may also include combustion from other biomass burning such as agricultural or prescribed burning. The vehicle exhaust category represents direct motor vehicle exhaust particles from both gasoline and diesel vehicles. Construction reflects construction and demolition activities. Ammonium nitrate and ammonium sulfate represent secondary species (i.e., they form in the atmosphere from the emissions of nitrogen oxides (NO_x), sulfur oxides (SO_x), and ammonia). Combustion sources such as motor vehicles and stationary sources contribute to the NO_x that forms ammonium nitrate. Mobile sources such as diesel vehicles, locomotives, and ships and stationary combustion sources emit the SO_x that forms ammonium sulfate. Ammonia sources include animal feedlots, fertilizers, and motor vehicles. The other carbon sources category reflects organic sources not included in the source attribution models, such as natural gas combustion, as well as secondary organic carbon formation. The unidentified category represents the mass that cannot be accounted for by the identified source categories. It can include particle-bound water, as well as other unidentified sources.

The figures on the following pages present the best available source attribution data from CMB modeling for selected regions. These presentations are representative of typical days when the State PM_{10} standards are exceeded (refer to Chapter 1, for a review of the State standards). The fractions of the constituents shown can vary daily and from year to year, depending on factors such as meteorology.

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San Joaquin Valley Air Basin

Figures 2-6 and 2-7 illustrate contributions to ambient PM in the San Joaquin Valley during the winter and on an annual average basis. These are the results from analysis of data collected during the California Regional $PM_{10}/PM_{2.5}$ Air Quality Study. (San Joaquin Valley Air Pollution Control District, 2003)

During the winter in Fresno secondary ammonium nitrate was the largest contributor to PM_{10}, formed from NOx emissions from mobile and stationary combustion sources, combined with ammonium. Emissions from wood smoke, vehicle exhaust, and road and agricultural sources also contribute significantly to PM_{10} levels. On an annual average basis, elevated concentrations of PM_{10} were associated with high levels of road and agricultural dust. Secondary ammonium nitrate, wood smoke, and vehicle exhaust particles also contributed significantly to annual PM_{10} concentrations.

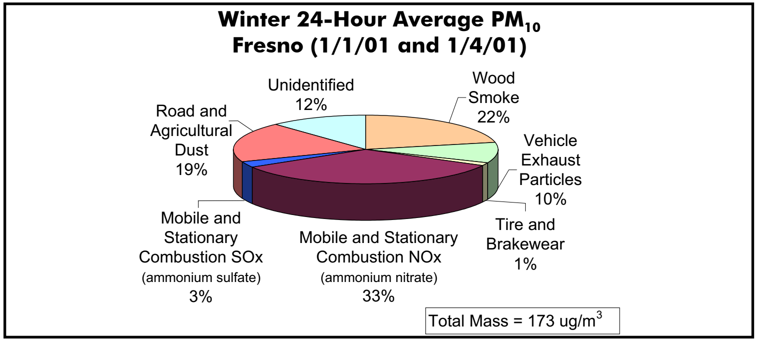

Figure 2-6

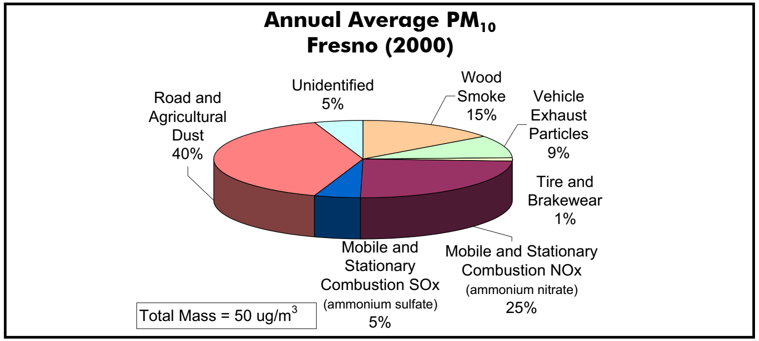

Figure 2-7

San Francisco Bay Area Air Basin

Figures 2-8 and 2-9 illustrate the sources of PM during the winter in the San Francisco Bay Area. The data are from the source apportionment analysis conducted by the Bay Area Air Quality Management District using samples collected during two special studies (Fairley, 1996, 2001).

During the winter, in San Jose, high PM concentrations are associated with high levels of wood smoke, primarily from residential wood combustion, and cooking. NO_x emitted from mobile and stationary combustion sources, in combination with ammonium, contributes about one-fourth of the PM levels in the form of ammonium nitrate. Particle emissions from mobile and stationary combustion sources are also a major contributor to $PM_{2.5}$. Road dust is a significant contributor to PM_{10}, but not $PM_{2.5}$.

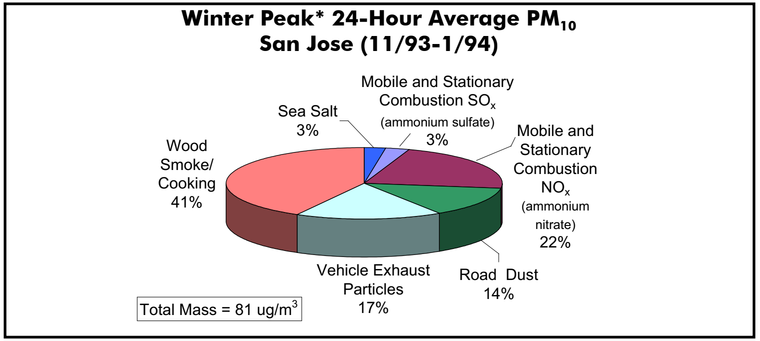

Figure 2-8

* Average of days with PM_{10} > 50 ug/m^3

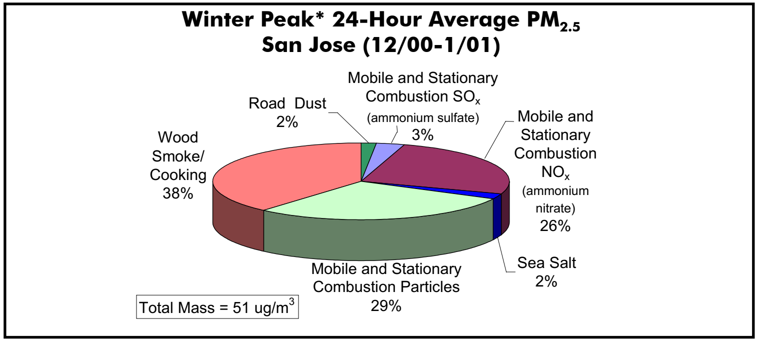

Figure 2-9

* Average of days with $PM_{2.5}$ > 40 ug/m^3

Sacramento Valley Air Basin

Figures 2-10 and 2-11 illustrate source contributions to ambient PM_{10} and $PM_{2.5}$ during the winter in Sacramento. The data are from the analysis of ambient air samples collected from November through January, during the six year period of 1991 through 1996 (Motallebi, 1999).

NO_x emissions from mobile and stationary combustion sources, combined with ammonium to form ammonium nitrate, is the largest contributor to ambient PM levels. Vehicle exhaust particle emissions and wood smoke from residential wood combustion also contribute significantly. While road and other dust is a significant component of ambient PM_{10}, its contribution to $PM_{2.5}$ is minor.

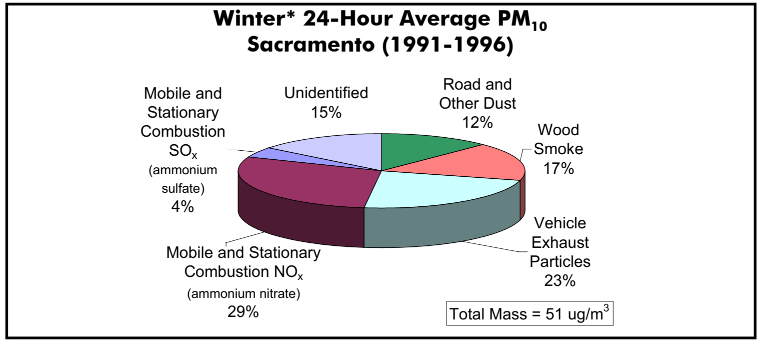

Figure 2-10

* Average of days with PM_{10} > 40 ug/m³

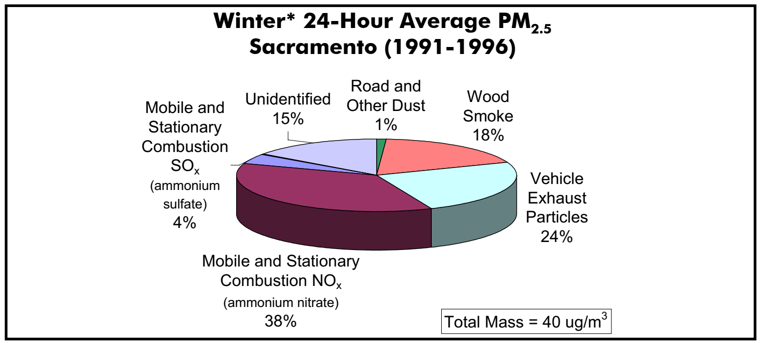

Figure 2-11

* Average of days with PM_{10} > 40 ug/m³

South Coast Air Basin

Data for Figures 2-12, 2-13, 2-14, and 2-15 are from the source apportionment analysis that the South Coast Air Quality Management District (SCAQMD) performed for the 1997 Air Quality Management Plan. SCAQMD collected samples during a one-year special study from January 1995 to February 1996, as part of the PM_{10} Technical Enhancement Program (SCAQMD, 1996).

On an annual basis, in Central Los Angeles, dust from roads and construction is the major contributor to ambient PM_{10}. This is not the case for the episode on November 17, 1995. In both cases, NO_x and SO_x emitted from mobile and stationary combustion sources, combined with ammonium, contribute significantly in the form of ammonium nitrate and sulfate. Vehicle exhaust particles and emissions from other carbon sources also contribute to both annual and episodic ambient PM_{10} levels.

Annual Average PM_{10}
Central Los Angeles (1995)

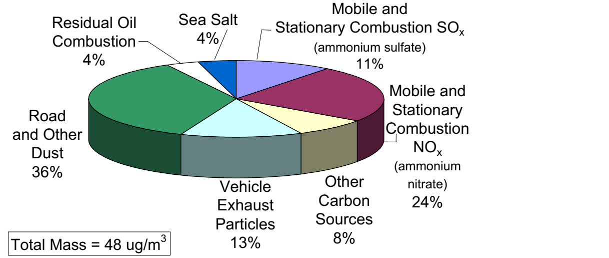

Figure 2-12

Maximum 24-Hour Average PM_{10}
Central Los Angeles (11/17/95)

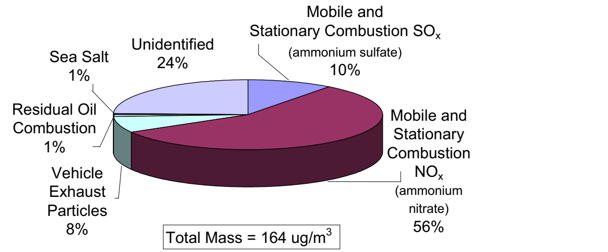

Figure 2-13

On an annual basis, in Rubidoux, dust from roads and construction is the major contributor to ambient PM_{10}. In contrast, dust was a minor contributor to the PM_{10} episode on November 17, 1995. In both cases, ammonium nitrate formed from NO_x emitted from mobile and stationary combustion sources, combined with ammonium, contributes significantly. Vehicle exhaust particles and emissions from other carbon sources also contribute to both annual and episodic ambient PM_{10} levels.

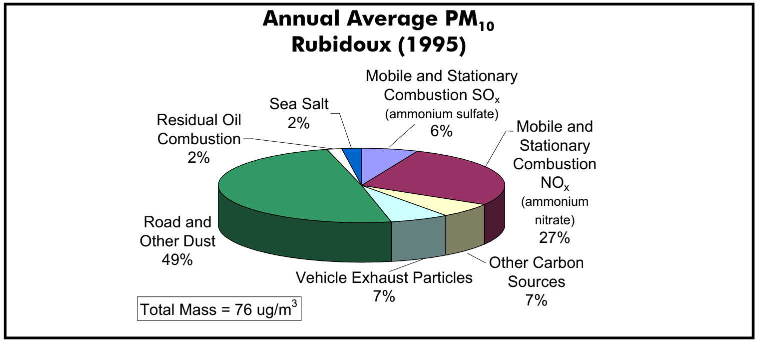

Figure 2-14

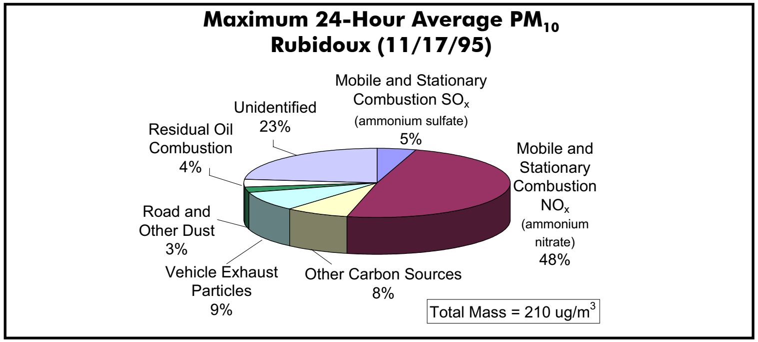

Figure 2-15

References for Particulate Matter:

Fairley, D. *Source Apportionment of Bay Area Particulates.* 1996; Personal communication.

Fairley, D. *$PM_{2.5}$ Source Apportionment for San Jose 4th Street.* 2001; Personal communication.

Motallebi, N. *Wintertime PM_{10} and $PM_{2.5}$ Source Apportionment at Sacramento, California.* Journal of the Air & Waste Management Association 1999; 49:PM-25-34.

South Coast Air Quality Management District. *"Modeling and Attainment Demonstrations"* in 1997 Air Quality Management Plan, Diamond Bar, California. 1996.

Schauer, J. J., Rogge, W. F., Hidemann, L. M., Mazurek, M. A., and Cass, G. R. *Source Apportionment of Airborne Particulate Matter Using Organic Compounds as Tracers.* Atmospheric Environment; 30: 22, 3837-3855, 1996.

San Joaquin Valley Air Pollution Control District. *2003 PM_{10} Plan: San Joaquin Valley Plan to Attain Federal Standards for Particulate Matter 10 Microns and Smaller.* Appendix N.

Carbon Monoxide

2003 Statewide Emission Inventory - Carbon Monoxide by Category

Carbon monoxide (CO) gas is formed as the result of incomplete combustion of fuels and waste materials such as gasoline, diesel fuel, wood, and agricultural debris. Mobile sources generate about 82 percent of the statewide CO emissions. Diesel-powered, on-road vehicles are small CO contributors. Stationary and area-wide sources of CO are the same types of fuel combustion sources that also generate NO_x. The stationary source contribution to statewide CO is small, due in part to widespread use of natural gas as a fuel and the presence of combustion controls.

CO Emissions (annual average)		
Emissions Source	**tons/day**	**Percent**
Stationary Sources	386	3%
Area-wide Sources	2129	15%
On-Road Mobile	8757	61%
Gasoline Vehicles	8616	60%
Diesel Vehicles	141	1%
Other Mobile	3158	22%
Total Statewide	***14429***	***100%***

Table 2-17

Carbon Monoxide - 2002 Air Quality

The State and national carbon monoxide standards are now attained in most areas of California. The requirements for cleaner vehicles and fuels have been primarily responsible for the reductions in CO, despite significant increases in population and the number of vehicle miles traveled each day. However, there are still two problem areas: a limited portion of Los Angeles County and the city of Calexico in Imperial County. While CO concentrations continue to decrease throughout most of the State, the CO problem in Calexico is unique in that this area shares a border with Mexico. There is a high likelihood that cross-border traffic contributes to the local CO problem in this area, and more study is needed to determine the most effective control strategy.

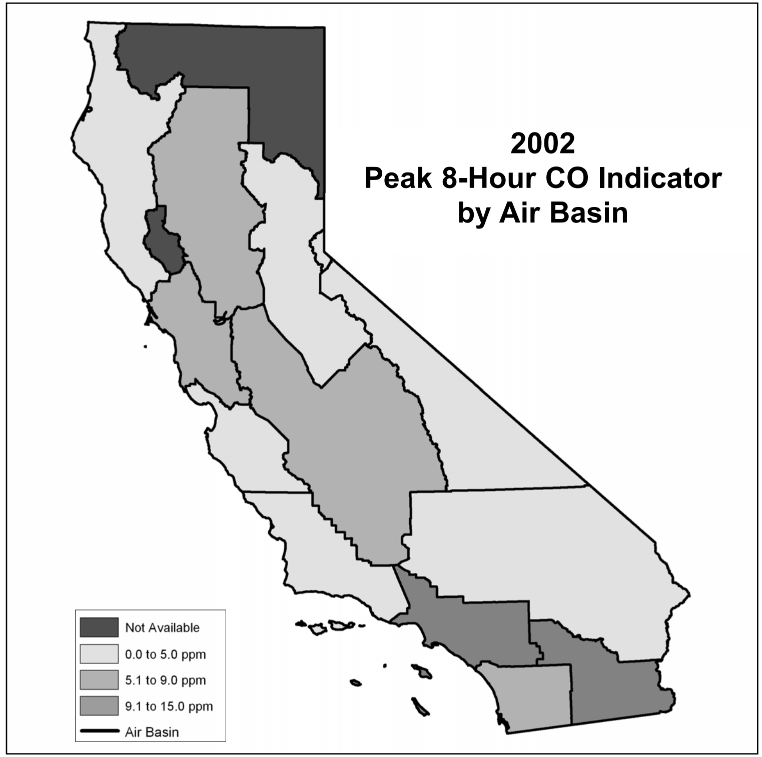

Figure 2-16

Carbon Monoxide - 2002 Air Quality Tables

Maximum Peak 8-Hour Indicator by Air Basin

AIR BASIN	2002 Maximum Peak 8-Hour Indicator in parts per million	Number of Days in 2002 above State 8-Hour Standard	Number of Days in 2002 above National 8-Hour Standard
Great Basin Valleys Air Basin	2.5	0	0
Lake County Air Basin	Incomplete Data	Incomplete Data	Incomplete Data
Lake Tahoe Air Basin	2.0	0	0
Mojave Desert Air Basin	2.0	0	0
Mountain Counties Air Basin	1.6	0	0
North Central Coast Air Basin	1.5	0	0
North Coast Air Basin	2.6	0	0
Northeast Plateau Air Basin	Incomplete Data	Incomplete Data	Incomplete Data
Sacramento Valley Air Basin	6.0	0	0
Salton Sea Air Basin	12.8	4	3
San Diego Air Basin	5.3	0	0
San Francisco Bay Area Air Basin	6.0	0	0
San Joaquin Valley Air Basin	5.3	0	0
South Central Coast Air Basin	2.7	0	0
South Coast Air Basin	9.4	1	1

Table 2-18

Sites with Peak 8-Hour Indicator Values above the State CO Standard

Salton Sea Air Basin

- Calexico-Ethel Street

South Coast Air Basin

- Lynwood

Sites with peak 8-hour indicator values above the level of the State CO standard during 2002. Sites in each air basin are listed in descending order of their 8-hour peak indicator value. If an air basin is not listed, the peak indicator values at sites in that air basin were not above the State CO standards.

Table 2-19